

REMARKS

By this amendment claim 13 is amended. Support for the changes to claim 13 can be found, *inter alia*, in Figure 1A. Claims 1-12, 18, 20 and 24 stand withdrawn from consideration and claim 14 was previously canceled. Claims 13, 15-17, 19, 21-23 and 25 are presented for further examination.

The rejection of claims 13, 16, 23 and 25 under 35 U.S.C. § 103(a) over Taguchi, US 6,469,448, in view of Baldwin, US 6,280,563, and Tonotani, US 6,181,069 is respectfully traversed with respect to the amended claims.

The invention relates to a plasma processing apparatus for treating an object with plasma. The apparatus is configured to supply radio-frequency power into a process chamber to generate the plasma.

As recited in independent claim 13, the apparatus comprises a plurality of metal-based radio-frequency antennas that penetrate a chamber wall and are disposed in the process chamber. The antenna are arranged to provide linear lines so that the directions of respective electric currents in adjacent antennas are the same. Further, as amended, claim 13 requires that adjacent antennas are parallel with each other on the same plane which is parallel to the object to be processed.

By requiring that adjacent antennas are in parallel with each other, on the same plane, and parallel to the object to be processed, the direction of the electric current flowing in adjacent antennas is the same (see Figure 1A). As shown in Figure 1B, with such an arrangement of the current through the

antennas, the induction electric fields in the respective plural antennas are strengthened by mutual interaction (see, e.g., page 9, line 31-page 10, line 4). Thus, with the above structure, the apparatus according to the present invention can efficiently generate a high-density plasma, and particularly a high-density plasma for plasma treatment of large area substrates (see, e.g., page 18, lines 4-8 of the specification).

The required structural relationship between the antennas and the object to be processed is not disclosed by any of the cited references. Pointedly, none of the references teach or suggest a plurality of radio-frequency antennas arranged within a plasma processing apparatus having linear lines so that the directions of the respective electric currents in adjacent antennas are the same, and wherein adjacent antennas are in parallel with each other and on the same plane which is parallel to the object to be processed.

Taguchi discloses an inductively coupled plasma (ICP) source wherein a plurality of one-turn antenna coils are disposed along the circumferential side wall of the plasma generating chamber. As acknowledge in Office Action, however, the one-turn coils of Taguchi are not linear, much less inside the processing chamber. The deficiencies of Taguchi are not remedied by any of the secondary references, whether considered independently or in any combination.

The secondary reference of Baldwin also teaches an ICP source having a coiled antenna. The antenna of Baldwin, however, is disposed on a top plate of a

chamber and, as show in Figure 2, comprises non-linear coils that are branched from the center to the periphery of the top plate.

Tonotani discloses a plasma apparatus that appears to include linear antennas. Tonotani does not, however, disclose linear antennas where the directions of the respective electric currents in adjacent antennas are the same and where the antennas are arranged parallel with each other on the same plane which is parallel to the object to be processed. There is no teaching in Tonotani to modify any of the disclosed antennas in such a way so as to arrive at linear antennas having the required relationships.

Applicants note, for example, that in the antennas disclosed in Figures 3, 12, 14 and 22 of Tonotani, the directions of the respective electric currents in adjacent antennas are opposed to each other. Applicants further note that the antennas disclosed in Figures 3, 4, 12, 13 and 14 of Tonotani are arranged parallel with each other, but on a plane that is perpendicular to the object to be processed, not parallel, as required by claim 13.

None of the embodiments disclosed by Tonotani include antennas arranged within a plasma processing apparatus having linear lines so that the directions of the respective electric currents in adjacent antennas are the same, and wherein adjacent antennas are in parallel with each other on the same plane which is parallel to the object to be processed. Moreover, Tonotani provides no teaching or suggestion that would have motivated one with ordinary skill to modify any of the disclosed antennas in such a way as to read upon the claimed

antennas. In view of the foregoing, reconsideration and withdrawal of the rejection are respectfully requested.

The rejection of claims 15 and 19 under 35 U.S.C. § 103(a) over Taguchi in view of Baldwin and Tonotani, and further in view of Glukhoy, US 2003/0168172, the rejection of claim 17 under 35 U.S.C. § 103(a) over Taguchi in view of Baldwin and Tonotani, and further in view of Holland, US 5,975,013 or Takagi, US 2004/0020432, and the rejection of claims 21 and 22 under 35 U.S.C. § 103(a) over Taguchi in view of Baldwin and Tonotani, and further in view of Grimbergen, US 6,390,019 are respectfully traversed.

As set forth below, none of the secondary references of Glukhoy, Holland, Takagi or Grimbergen remedy the deficiencies of Taguchi, Baldwin and Tonotani, as applied to independent claim 13.

As set forth in the Reply filed October 12, 2006, Holland and Grimbergen each teach a coiled antenna that is located outside the process chamber. Neither reference discloses or suggests linear antennas, much less linear antennas arranged such that adjacent antennas are parallel with each other on the same plane and parallel to the object to be processed.

Glukhoy and Takagi each teach a U-shaped coil where the directions of the electric currents flowing in adjacent portions of the U-shaped coil are opposite to each other, so that the electric fields of these electric currents are weakened when they are combined.

Because Glukhoy, Holland, Takagi and Grimbergen fail to remedy the deficiencies of Taguchi, Baldwin and Tonotani as applied to independent claim 13, claims 15, 17, 19, 21 and 22, which depend either directly or indirectly from claim 13, are patentable at least for the reasons that claim 13 is patentable. Reconsideration and withdrawal of these rejections are respectfully requested.

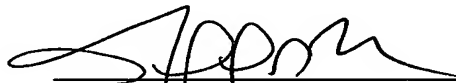
The application is respectfully submitted to be in condition for allowance, and prompt favorable action thereon is earnestly solicited.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #101249.52602US).

Respectfully submitted,

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